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ARTIFICIAL DIELECTRICS FINAL REPORT

12 MARCH 1990

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PERCENTAGE OF WORK COMPLETED



TASK 1: MATERIALS FABRICATION

No work was done on Task 1.

STATEMENT "A" per Wally Smith
ONR/Code 1131
TELECON 3/21/90

VG

TASK 2: MEASUREMENT AND CHARACTERIZATION

No work was done on Task 2.

TASK 3: THEORY AND MODELING

Task 3 was 5% completed.

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DESCRIPTION OF WORK COMPLETED UNDER TASK 3

A literature search was performed to determine the state-of-the-art in modeling the electromagnetic wave reflection and transmission of periodic arrays of metallic and resistive patches in multilayer structures. The list of references is attached. A preferred computational method was selected¹ that could be implemented within the resource constraints of this contract. Satisfactory implementation of the algorithm was not completed before the work was stopped. (KR) (—)

¹ S. Contu and R. Tascone, "Scattering from Passive Arrays in Plane Stratified Regions," Electromagnetics 5(4), 1985, p. 285.
R. Orta, R. Tascone and R. Zich, "A Unified Formulation for the Analysis of General Frequency Selective Surfaces, Electromagnetics 5(4), 1985, p.307.

YEAR	AUTHORS	TITLE	JOURNAL	VOL.	NO.	PAGE
1967	Qi, R. H., Kuyumjian, R. G., Peters, L. J.	Scattering by a Two-Dimensional Periodic Array of Narrow Plates	RADIO SCIENCE	3	11	1347
1970	Chen, C. C.	Scattering by a Two-Dimensional Periodic Array of Conducting Plates	IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION	AP-18	5	660
1971	Chen, Chao-Chun	Transmission Through a Conducting Screen Perforated Periodically with Apertures	IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES	19	5	677
1971	Chen, Chao-Chun	Diffracted Electromagnetic Waves by a Conducting Screen Perforated Periodically with Circular Holes	IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES	19	5	475
1972	Lee, S. R. I.	Electromagnetic Boundary Conditions for Linear Regions	JOURNAL OF PHYSICS	50		2147
1973	Lee, W. R., Voss, W. A. G., Bozney, D. F.	Generalized Approach to Multiphase Dielectric Mixture Theory	JOURNAL OF APPLIED PHYSICS	44	9	3897
1975	Macdonald, I.	On Theory of Self-Resonant Grid Quasi-Optical Devices	THE BELL SYSTEMS TECHNICAL JOURNAL	54		1772
1975	Macdonald, I.	Resonant Grid Quasi-Optical Devices	THE BELL SYSTEMS TECHNICAL JOURNAL	54	27	767
1977	Macdonald, I.	Scattering by an Infinite Periodic Array of Thin Conductors on a Dielectric Sheet	IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION	25	1	70
1978	Macdonald, I.	Measure Absorbing Finite Dielectric Composites	JOURNAL OF THE AMERICAN CERAMIC SOCIETY	59	9	434
1978	Macdonald, I.	A Mean-Field Effective Medium Theory of Random Magnetic Arrays	PHYSICA (INDIA)	11	2	723
1978	Macdonald, I.	Scattering from Thin and Finite Dielectric Fibers	JOURNAL OF THE OPTICAL SOCIETY OF AMERICA	68	2	194
1978	Macdonald, I.	The Reflection of Electromagnetic Waves from Amorphous Periodic Structures	APPLIED PHYSICS	19	0	405
1978	Macdonald, I.	Coherent Electromagnetic Wave Propagation Through Randomly Distributed Dielectric Scatterers	PHYSICAL REVIEW	190	8	2488
1978	Macdonald, I.	Long-wavelength Electromagnetic Propagation in Heterogeneous Media	PHYSICAL REVIEW	218	6	2748
1980	Shen, Peng	Theory for the Dielectric Function of Granular Composite Media	PHYSICAL REVIEW LETTERS	45	1	60
1981	Macdonald, I.	CPA Approach for Randomly Distributed Anisotropic Ferromagnetic Para-Spin-Flip Critical Field	JOURNAL OF PHYSICS	14C		4415
1982	Macdonald, I.	Equivalent Circuit Model for Arrays of Square Loops	ELECTRONIC LETTERS	18	7	294
1982	Macdonald, I.	CPA Approach for Randomly Distributed Anisotropic Antiferromagnetic Spin-Flip Transition and AFMR	JOURNAL OF PHYSICS	15C		3569
1982	Macdonald, I.	A Study on the Magnetic Properties of Two-Phase Particulate Magnetic Composites	JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS	30	0	37
1983	Macdonald, I.	Dielectric Constant of a Composite Inhomogeneous Medium	PHYSICAL REVIEW	278	8	5098
1983	Macdonald, I.	The Synthesis of Surface Reactance using an Artificial Dielectric	IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION	AP-31		471
1983	Macdonald, I.	Double-Square Frequency Selective Surfaces and their Equivalent Circuit	ELECTRONIC LETTERS	19	17	675
1984	Macdonald, I.	Effective Dielectric Constant of a Metal-Dielectric Composite	PHYSICAL REVIEW	30B	2	1008
1984	Macdonald, I.	Bounds for the Complex Dielectric Constant of a Two-Phase Composite	PHYSICA	176A	0	472
1984	Macdonald, I.	AC Conductivity of a Random Medium: A Percolation Approach	IEEE TRANSACTIONS ON ELECTRICAL INSULATION	19	3	205
1984	Macdonald, I.	Microwave Propagation in Random Particulate Composites	PHYS. STAT. SOL.	81a	0	71
1984	Macdonald, I.	On the Improvement of the Effective-Medium Approximation to the Percolation Conductivity Problem	JOURNAL OF PHYSICS	17C	0	1941
1984	Macdonald, I.	Scattering Analysis of Dielectric Subreflectors	ELECTROMAGNETICS	5	4	375
1985	Macdonald, I.	Scattering from Passive Arrays in Phase Stratified Regions	ELECTROMAGNETICS	5	4	285
1985	Macdonald, I.	Scattering from General Periodic Screens	ELECTROMAGNETICS	5	4	515
1985	Macdonald, I.	Electromagnetic Propagation in Close-Packed Disordered Suspensions	APPLIED PHYSICS	31B	8	515
1985	Macdonald, I.	Scattering by Small Thin Dielectric Particles	APPLIED PHYSICS	30B	0	775
1985	Macdonald, I.	Design of Single-Layer Frequency Selective Surfaces for Multiband Reflector Antennas	ELECTROMAGNETICS	5	4	331
1985	Macdonald, I.	On Stabilization of the Bandwidth of a Dielectric Surface by Use of Dielectric Subbs	ELECTROMAGNETICS	5	4	345
1985	Macdonald, I.	Effective-Medium Theories for Two-Phase Dielectric Media	JOURNAL OF APPLIED PHYSICS	57	6	1990
1985	Macdonald, I.	A Unified Formulation for the Analysis of General Frequency Selective Surfaces	ELECTROMAGNETICS	5	4	307
1985	Macdonald, I.	Electromagnetics: Special Issue on Frequency Selective Surfaces	ELECTROMAGNETICS	5	4	763
1987	Macdonald, I.	Analytic Layered Absorbers on Cylindrical Structures	ELECTROMAGNETICS	7	0	117
1987	Macdonald, I.	Effective Conductivity of Periodic Composites Composed of Two Very Unequal Conductors	JOURNAL OF MATHEMATICAL PHYSICS	28	10	2916
1987	Macdonald, I.	Fractal Aspects of the Dielectric Response of Charge Carriers in Disordered Materials	JOURNAL OF APPLIED PHYSICS	67	7	1
1987	Macdonald, I.	Revering and Scattering Characteristics of Circular Patch Antenna Array	JOURNAL OF ELECTROMAGNETIC WAVES AND APPLICATIONS	7	3	353
1988	Macdonald, I.	Eddy Currents in Heterogeneous Media	JOURNAL OF ELECTROMAGNETIC WAVES AND APPLICATIONS	7	5	473
1988	Macdonald, I.	A Generalized Self-Consistent Method for the Effective Conductivity of Composites with Ellipsoidal Inclusions and Cracked Bodies	JOURNAL OF APPLIED PHYSICS	63	3	208
1988	Macdonald, I.	Theoretical Treatment of Ferroelectric Composites Using Monte Carlo Calculations	JOURNAL OF APPLIED PHYSICS	64	10	5097
1988	Macdonald, I.	Special Issue on Numerical Methods for Electromagnetic Wave Interactions	WAVE MOTION	10	6	497
1988	Macdonald, I.	Electromagnetic Scattering by a Dielectric Cylinder Partially Covered by Conductors	JOURNAL OF ELECTROMAGNETIC WAVES AND APPLICATIONS	7	1	21
1989	Macdonald, I.	Surface-Wave Reflection and Refraction at an Impedance Discontinuity	JOURNAL OF APPLIED PHYSICS	66	8	3437
1989	Macdonald, I.	Application of the Discrete Fourier Transform Method to Thin Dielectric Structures	IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION	37	1	1277
1989	Macdonald, I.	A Spectral Iteration Technique for Analyzing Scattering from Circular Analog Absorbers	IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION	37	1	1372

Artificial Defectives Measurements References

1984 Gauss Arthur J	Radar Absorbing Loops	US Army Ballistic Research Laboratory Technical Report BR-IR-2599, October 1984
1984 Jacobs Israel S	Advanced Artificial Defective Materials for Millimeter Wavelength Applications	Annual Technical Report, Contract No. N00014-83-C-0447, General Electric Company, 26 October 1984, Report Period 1 Aug 1983 - 30 Sep 1984 prepared for DAR
1985 Jacobs Israel S	Advanced Artificial Defective Materials for Millimeter Wavelength Applications	Annual Technical Report, Part A, Contract No. N00014-83-C-0447, General Electric Company, Report Period 1 October 1984 - 30 September 1985 prepared for DAR